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ABSTRACT

This paper utilizes a sociocultual perspective to argue that content literacy development and subject content learning are inseparable and that it is every classroom teacher's responsibility to support all students' academic language/literacy (LL) development needed for the learning of relevant content. Through an analysis of the New Jersey Core Curriculum Content (NJCCC) Standards (1996, 2002), the paper calls for increased attention to the integration of academic LL development and subject area content learning in all subject areas. Focus in the paper is on the Standards' implications for teachers working with linguistically diverse learners at both curriculum and instructional levels. Key questions guiding the study reported in the paper include: (1) What terms in the current NJCCC Standards serve to indicate the expectation for academic LL skills within each content area? (2) How may these terms be categorized into a framework that may provide directions for systematic integration of academic LL skills development and subject content learning at the curriculum level? and (3) What are the implications of this analysis for classroom teachers working with linguistically diverse students at the instructional level for effective content teaching? Findings indicate that overall there are LL skills requirements associated with all the major knowledge structures and in every selected content area. Appended are a list of 70 verb phrases identified as those indicating potential demands in the NJCCC and three examples from three content areas to demonstrate how progress indicators for the same current topic may be organized into Mohan's Knowledge Framework. (Contains 3 figures and 39 references.)(Author/NKA)

# Content Literacy and Language Development across the Curriculum: What Do Core Curriculum Content Standards Have to Say?

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***Abstract***

The paper utilizes a sociocultural perspective to argue that content literacy development and subject content learning are inseparable and it is every classroom teacher's responsibility to support all students' academic language/literacy (LL) development needed for the learning of relevant content. Through an analysis of the New Jersey Core Curriculum Content (NJCCC) Standards (1996, 2002), it calls for increased attention to the integration of academic LL development and subject area content learning in all subject areas. The focus is on the Standards' implications for teachers working with linguistically diverse learners at both curriculum and instructional levels. Key questions guiding the study include: 1) What terms in the current NJCCC Standards serve to indicate the expectation for academic LL skills within each content area; 2) How may these terms be categorized into a framework that may provide directions for systematic integration of academic LL skills development and subject content learning at the curriculum level? 3) What are the implications of this analysis for classroom teachers working with linguistically diverse students at the instructional level for effective content teaching?

**Content Literacy and Language Development across the Curriculum: What Do Core Curriculum Content Standards Have to Say?**

In the context of today's standards movement and a rapidly increasing population of language minority students who often have to struggle for academic success in American schools, regular classroom teachers are facing the challenge of meeting mandated curriculum standards as well as the needs of linguistically diverse students. In most cases, regular classroom teachers are not prepared to handle the ever-increasing number of ESL students in their classrooms. Their reluctance stems from school structures that reinforce a separation between literacy and content learning by dictating that literacy should be taken care of by language teachers and content area teachers need only be concerned with subject content teaching. This perception is mirrored in many US teacher preparation programs that relegate the education of ESL students to separate TESOL programs or address these concerns superficially and marginally as a sub-issue of diverse learners within their regular teacher preparation programs. Curriculum content standards, on the other hand, both recognize and challenge this forced dichotomy and explicitly encourage integration of literacy and content learning.

This article utilizes a sociocultural perspective and text-based analysis of curriculum content standards to argue that content literacy development and subject content learning are inseparable and that regular classroom teachers must therefore be prepared to support ESL students' academic language/literacy (LL) development within the context of content instruction. Our analysis centers on the New Jersey Core Curriculum Content (NJCCC) Standards (1996, 2002), which we consider representative of state and national efforts to articulate an understanding of education and learning that

guide curricular and instructional practice. Key questions guiding the study included: 1) What terms in the current NJCCC Standards indicate the expectation for academic LL skills within each content area and with what frequency do they occur within each content/subject area; 2) Does categorization of these terms within an existing framework of knowledge structures provide guidance for systematic integration of academic LL skills development and subject content learning at the curriculum level? 3) What are the implications of this analysis for future revision of curriculum standards and effective content teaching practice by classroom teachers working with linguistically diverse students? This article will focus primarily on the findings as they relate to the second question, while providing a brief background on the findings from the first and alluding to the practical implications they both hold for the final question.

**Theoretical Perspectives**

Existing studies (see Alvermann & Phelps, 1998) have revealed a close relationship between content knowledge and content related LL skills. The concept of "register" defined by Halliday *et al* as "a variety of language distinguished according to its use" (1964, p. 87) indicates that academic language is often discipline specific. Capability of communicating about science, for instance, is usually gained through engaging in exploration of science (Halliday & Martin, 1993; Martin & Veel, 1998; Veel, 1997) and viewed as a necessary skill for successful studies of science. Thus, if imbedded learning is a goal, all regular classroom teachers must address academic LL skills development as a central component of their instructional objectives.

While it is recognized that learning new registers (Halliday, 1985), as well as when and how to deploy them, is a very important part of the apprenticeship into literacy that children undertake in school (Wells 1996), few studies have directly addressed the

importance of situating the learning of new registers within the context of relevant subject content knowledge. Content literacy researchers have advocated the use of literacy skills as necessary for the acquisition of new content in a given discipline (see Alvermann & Phelps, 1998; Jacobson, 1998). During this same period, Newell (1998) found that classroom teachers often treat language/literacy development and subject content learning as separate enterprises. In the field of second language education, Cummins' distinction between Basic Interpersonal Communicative Skills (BICS) and Cognitive Academic Language Proficiency (CALP) has helped L2 (i.e., second language) educators realize that it is not unusual for ESL students to require 4 to 7 years to develop their CALP for academic success in various content areas (Cummins, 1981, 1989; Collier, 1989). However, in today's American schools, more and more ESL students are mainstreamed shortly after developing their BICS. Such students appear to be fluent communicating in English yet lacking CALP, struggle in their academic studies. Lacking an understanding of the difference between BICS and CALP (and for a variety of other political and financial reasons), school districts that administer the same standardized tests for English speaking students and ESL students often further "reinforce negative impressions of English language learners" (Freeman & Freeman, 1998, p. 252). Neither an understanding of the relationship between academic LL proficiency and discipline knowledge nor a firm belief in integration guarantees that a teacher will change his/her instructional practice. Edwards and Mercer (1987) have argued that when there is a conflict between espoused beliefs and perceived external requirements, teachers' actual practices are likely to be swayed by the latter. Support from external policy sources and educational administrators are important for any innovative practice to take hold. In the

US, state standards are perceived as an influential external force. Clearly, a very important function of the Standards is to guide curriculum and instruction which, when ideally translated into classroom practices, are usually student-centered activities. Thus, at the pedagogical level, the relevant question is: How may standards be translated into classroom activities that systematically connect academic LL development and subject area content learning? From the field of language education, Mohan's Knowledge Framework (KF) (Mohan, 1986) has proven effective in helping classroom teachers to systematically integrate language development and content learning in subject areas (e.g. Early, 1990; Early et al., 1989; Mohan, 1990; and Tang, 2001; etc.). Drawing upon ethnographic research (Werner & Schoepfle 1987) and the work of systemic-functional linguistics (See Eggins 1994, Halliday 1985, 1994, Martin 1985, 1992), the KF was originally proposed as a heuristic framework for the analysis of human activities and social practices in terms of meaning. Within any activity the KF accommodates at least six basic Knowledge Structures (KSs) that form relational pairs associated with either theoretical or practically oriented activities and have distinct linguistic features (see Figure 1).

[Insert Figure 1. Linguistic Features Associated with Different KSs (Mohan & Huang, 2002)]

Given its orientation towards the analysis of human activities and the ability of the framework to provide clear links between content and language, the KF appears to be an appropriate tool for the analysis of the Standards in that it: 1) directly connects the Standards to the design of classroom activities and, 2) demonstrates the possibilities for systematically integrating literacy and content across the curriculum.

**Methodology and Data Analysis Framework**

The primary data source for this study was the NJCCC Standards for all core subject areas. Verbs from standard progress indicators function as explicit indicators of LL requirements and form the primary reference point for analysis. Similar to many state level standards, the NJCCC Standards cover eight content areas: cross-content workplace readiness, arts, comprehensive health and physical education, language arts, mathematics, science, social studies, and world languages. Each standard includes cumulative progress indicators at specific benchmark grades, which number between five (cross-content workplace readiness) and sixteen (mathematics). Excluded from this study are the content areas of language arts and world languages, as these two areas are traditionally viewed as official territories for LL skills development. The remaining six areas represent those where language and literacy skills are less commonly highlighted and the contribution to teaching practice is most needed.

The analysis conducted spans two versions of the NJCCC Standards: 1996 and 2002 (for Math and Science). The original analysis was conducted on the 1996 document. In the Fall of 2002, following the acceptance by the Department of Education of the revised version in the areas of math and science, NVivo Qualitative Research Software (QSR, 2000) was utilized to replicate and enhance the comparative analysis of these Standards.

The text analysis, whether completed manually or computer-aided, involved identifying verb phrases in each progress indicator that signal a requirement for LL skills. As outcome-oriented verb phrases were identified they were categorized either directly into Mohan's Knowledge Framework (KF) of Knowledge Structures (KS) (Mohan, 1986) or an emergent 'free node' for further cross-coder analysis. Grounded theory informed

the research design that relied on capturing such emergent themes and allowing for their growth and on-going validation (Strauss & Corbin, 1998) while joint and cross-coding approaches were utilized by the researchers to increase validity (Richards, 1999).

As the standards were coded for key verb phrases according to their associated KF, emerging patterns and frequency of use across content areas was explored. In both datasets, LL demand was subsequently calculated by identifying the percentage of verb phrases signaling LL skills requirement with resulting levels reported within a relational matrix associating content areas with Mohan's Knowledge Framework.

Using the KF as an organizing framework, the second level of analysis categorized the progress indicators associated with LL demands into each of the six KSs. The following criteria were used when deciding how to categorize the identified terms:

| **KSs** | **When an indicator may require students to address questions about:** |
|---|---|
| Description | Who, what, where? What persons, materials, equipment, items, settings? |
| Sequence | What happens? What happens next? What is the plot? What are the processes, procedures, or routines? |
| Choice | What are the choices, conflicts, alternatives, dilemmas, decisions? |
| Classification | What concepts apply? How are they related to each other? |
| Principles | What principles are there? (Cause-effect, means-end, methods and techniques, rules, norms, strategies) |
| Evaluation | What values and standards are appropriate? What counts as good or bad? What are typical reasons for choosing one object or course of action over anther? What are usual aims and goals? |

(Based on Mohan, 1986, p.36-37)

While categorization within the Knowledge Framework is often straightforward, contextual analysis of verb phrases and cross-coder interpretations of more complex structure are often necessary to increase reliability when applying the above criteria. For instance, while "describing geometry in nature" is obviously a task of Description, "describing how certain quantities change over time" is more a task of Principles that requires students to express cause-effect or condition-result relations. Verb phrases articulated in more general terms (such as "solve problems", "discuss", "explain work", "read", "write") may be categorized into all six KSs because they either involve all six KSs or may be for any one of the KSs depending on specific tasks. In addition, verbs such as "understanding" and "knowing", which are used in many progress indicators, may or may not indicate language requirements depending on the context in which they are used. (Figure 3 summarizes the result of the categorization).

The final level of analysis draws directly from Mohan and Huang's studies related to the instructional usefulness of the KF (Huang, 1996, 2000; Mohan & Huang, 2002; Mohan & Naerssen, 1997) which employ a discourse analysis approach based on specific linguistic features (SFL) (see Eggins, 1994; Halliday, 1985, 1994; Martin, 1992; etc.) and cultural ethnography (Werner and Schoepfle, 1987) to reveal systematic connection between SFLs and KSs. Figure 1 represents a summary of the findings of these studies and demonstrates how language systems such as reference, conjunction, transitivity process, and lexis may be utilized in specific ways when semantic macro-organization of a text needs to be verbally represented.

This analytical approach reveals areas of LL strength and weakness and simultaneously, underscores the possibilities of using this analysis and the Knowledge

Framework to intentionally organize classroom instruction for systematic integration of LL skills and subject content learning across the curriculum.

**Results and Discussion**

In the NJCCC Standards document, analysis of progress indicators documented the use of 70 verb phrases indicating obvious or potential LL demands (examples include: "analyze patterns", "clarify thinking", "describe the relationship", "compare properties", "construct arguments" and are listed in Appendix I). Levels of demand for each content area were calculated by dividing the number of progress indicators signaling LL demand to the total number of progress indicators in each content area. Figure 2 summarizes the result of this initial analysis.

[Insert: Figure 2: Level of Language/Literacy Demands in the NJCCCS]

As evident from the above analysis, LL requirements in the NJCCCS are very demanding. In any selected content area, the percentage of progress indicators signaling a LL requirement exceeds 45%. Highest among these are Social Studies and Health & Physical Education. While the finding for Social Studies is not surprising due to its traditionally heavy reliance on print materials and document-guided activities, the high LL demand in Health and Physical Education deserves additional consideration as physical education is commonly regarded as one of the areas with the lightest language requirement. Two explanations may be offered. First, the Standards document combines health education with physical education and sets its goal as "develop[ing] citizens who are both health-literate and physically educated" (NJCCCS, 1996:2-1). Health literacy is defined as the capacity of individuals to obtain, interpret, and understand basic health information and services, and the competence to use such information and services in

ways that enhance health (Joint Committee on National Health Education Standards, 1995). It is articulated as an indispensable step leading to a theoretical understanding of the significance of participating in a variety of physical activities. Thus physical education becomes an integral part of health education. Secondly, even within physical education, the focus is no longer solely on human kinetics. To make physical movements relevant to health education, students are expected to address the "What", "How", "When" and "Why" questions about physical movements in order to "take responsibility for their own lives by acting conscientiously" (NJCCCS, 1996:2-1). Such requirements for a theoretical understanding of applying physical skills have made the language/literacy skills more explicit and demanding.

[Insert Figure 3: Percentage of uses of items associated with different KSs among all items signaling language/literacy demands]

In the KF, any activity is positioned within one of two KS categories: specific/practical (Description, Sequence, and Choice) and general/theoretical (Classification, Principles and Evaluation). The analysis documented in Figure 3 shows clearly that in all six content areas under analysis, there are LL requirements associated with each KS. Across the board, LL demands for Principles are higher than Sequence, Evaluation greater than Choice. This finding clearly indicates that the students not only have to verbalize sequence/procedures and make decisions, but also need to articulate reasons behind actions. The NJCCC Standards illustrate and support Mohan's contention that it is no longer enough for students to simply describe the water cycle or select a method to keep the environment cleaner. Students need to demonstrate higher thinking processes such as explaining the water cycle itself, emphasizing cause-effect, condition-

result relations (Mohan, 1986, p. 80), evaluating options, and making judgments by referencing standards or potential benefits (Mohan, 1986, p.84-85).

This pattern emphasis does not extend to LL demands in the linked KSs of Classification and Description. Only for Math and Science of 1996 is heavier LL demand found in Classification than in Description. This finding is not surprising since many research studies have indicated that conceptual knowledge development in science and math is crucial to students' success in the learning of these two subjects (see Cocking & Mestre, 1988; Martin & Veel, 1998; Veels, 1997). Lemke's studies on the uses of language in classrooms have also revealed that language of math and science is used to "deal mainly with abstract generalization and logical relationship" while the language of other subjects seems to be used more to "deal with specific and concrete relations" (Lemke, 1990, p. 158-159). The analysis only points more explicitly to a demand from an external force (via the Standards) for instructional practice that focuses more on the verbalization of an understanding of conceptual knowledge in math and science. However, the 2002 version of math and science standards reversed the emphasis: as in all other chosen areas, LL demand seems higher for the KS of Description, the specific, practical aspect of the pair in an activity. Additional analysis within the context of the document reveals that the shift is not on the focus of learning but the way to express the learning: there are more progress indicators that ask for examples or descriptions associated with targeted concepts. This is especially obvious in the area of math, where for every concept introduced, learners are required to describe it in a variety of ways. As for the heavier demand of LL requirements associated with Description in other content areas, the finding may be explained by the fact that in these areas 1) less conceptual

knowledge is involved in the learning process; 2) more attention is distributed to an understanding of concrete examples in relation to specific people, materials, equipment, items, and settings. This is not to say that LL demand for the KS of Classification is replaced, simply that it is weaker across content areas. Generally speaking, Figure 3 reveals that while articulating concrete examples is given greater attention, the capability to verbally reason and rationalize decisions are also well represented. Maintaining a strategic balance among knowledge structures becomes a value worthy of nurturing.

**Instructional Implications of Findings at The Curriculum and Classroom Level**

The importance of this analysis extends beyond intellectual enterprise and into instructional practice. The discussion of these findings center around two issues worthy of discussion: 1) linguistic features associated with different KSs; 2) development of content learning activities that systematically engage students in using LL skills associated with all KSs. A discussion of the first issue may help to raise educators' awareness of the specific linguistic features associated with different KSs in various content areas. The second discussion focuses on providing opportunities to engage students in using their LL skills by influencing pedagogical strategies at the curriculum design and instructional implementation levels. A summarized discussion of these points follows.

The reality in classrooms is that too often students do not seem to have a sufficient command of the discipline-specific language needed either to figure out what is actually going on or to express what they know about the subject. For instance, many students have trouble translating between mathematical symbols, mathematical English sentences, and ordinary English. Lemke effectively argues that while languages of

different areas use the same grammatical and semantic resources, they use them in different ways and for varying purposes (see Lemke, 1990, p. 156-160). The difference is very often "more than a matter of special vocabulary: It is a matter of the ways these special words are used together, the semantic relations we construct among them when we use them" (Lemke, 1990, p. 155). This problem is one that is most appropriately addressed by math teachers as an integral component of instruction.

Using science as an example, consider the following overlay of such language within the KS Framework. When working on a topic of bacteria, students may very well be asked to address the following questions that require students to construct different KSs in relation to bacteria:

| **Questions/Activities** | **KS to be constructed**: |
|---|---|
| 1. Among the organisms shown, which would you classify as a bacterium? Why? | Classification |
| 2. Draw and describe the primary features of bacteria. | Description |
| 3. Discuss the conditions under which bacteria thrive. | Principles |
| 4. Illustrate the life cycle of bacteria? | Sequence |
| 5. How would you determine whether certain bacteria are beneficial or harmful to human beings? | Evaluation |
| 6. Which characteristics of bacteria contribute most to its long-term survival? | Choice |

Given that all content areas require LL skills associated with the KSs that have their own specific linguistic features, the next consideration is how activities may be organized to ensure systematic integration of LL development and content learning. An easy way for classroom teachers to implement standards-oriented LL requirements within

learning activities is to first break a content topic down into the six KSs (Appendix II provides specific examples from three content areas demonstrating how progress indicators for a single content topic can be mapped into the KF.). Once progress indicators for the same grade level and topic can be categorized into the basic KSs, teachers can more easily recognize the KF as 1) a useful way to organize classroom activities that systematically integrate LL development and content learning and 2) an effective tool for explicitly understanding LL requirements within the context of the standards and promoting well-rounded learning.

The analysis of the Standards strongly suggests that classroom teachers can no longer afford to ignore the LL aspects of subject area content teaching if the Standards are to be sincerely addressed. Students' capability of using language to engage in discipline specific activities is articulated as a requirement in the Standards. By using the KF to organize activities across the curriculum, classroom teachers may improve students' ability to use language in ever more specific, expressive, accurate and sophisticated ways.

## A KF Perspective: Limitations of Existing Standards and Promises for Classroom Practice

If one accepts the value of utilizing the KF to identify critical KSs that promote learning, then it becomes a particularly useful tool for identifying holes within current Standards. While this document primarily reports on the overall analysis of the standards, an evaluation focused on benchmark grade levels reveals holes, weaknesses and limitations within and between these levels of the standards. For example, within Math Standard 4.2 of 2002 (Geometry and measurement), no progress indicators could be identified for the KSs of Evaluation and Choice at the grade levels from 2 to 8. A lack of

attention to LL skills associated with Evaluation and Choice at these levels may send a message to teachers that students do not need to make decisions based on reasoning at this point of learning and they may be less inclined to design activities that engage students in making decisions based on reasoning. Such hidden messages may pose potential problems in later years when related upper level progress indicators need to be addressed. It is generally accepted by educators that thinking and LL skills are developed over time and continuity from the early grades is critical. Thus, the KS analysis process can be used to identify critical weakness in the current NJ standards document and ensure a comprehensive range of thinking and LL skills across academic levels and tasks to ensure learning and development in these areas.

Where standards documents are not reanalyzed or adjusted sufficiently, classroom teachers can also be empowered to utilize the KF to bring more robust standards to life in their classrooms. Classroom research (e.g. Early, 1990; Early et al. 1989; Mohan 1990; and Tang, 2001) in relation to the use of the KF has proven that the it is an effective tool to bring LL skills and content learning together in a systematic way. Coupled with this research, it is clear that introducing teachers to the KF as an organizing framework for viewing standards and designing and organizing classroom learning activities, holds practical promise for comprehensively and systematically improving learning. Supporting teachers to proactively design and manage their classroom interactions according to the KF could prove a faster path to implementing the spirit of the Standards in a way that will support effective learning.

**Conclusion**

Implementing curriculum standards while helping linguistically diverse learners in classrooms is a common concern of today's educators in the United States. The current educational focus on curriculum standards has begun to impact the classroom reality. Teachers are required to design their instruction to address the standards and tests are being developed according to these established standards. While the current standard and test-driven assessment focus certainly has its limitations, relatively well-developed standards can also serve to encourage innovative practices. This article examines, through KF-referenced analysis, how the standards may be utilized to encourage desired educational practice. Though the analysis mainly focuses on the New Jersey Curriculum Standards, the implications transcend the State of New Jersey as state level standards are developed based on the national standards of various professional organizations. Core Curriculum Standards throughout the country represent an external force that articulates the importance of academic language development across the curriculum.

Using Mohan's Knowledge Framework, this study demonstrates how NJCCC Standards progress indicators fall into a variety of Knowledge Structures, representing specific thinking skills and realized through the use of specific linguistic features. The findings indicate that overall there are LL skills requirements associated with all the major KSs and in every selected content area. By introducing systematic connections between the KSs and specific linguistic features (reference, conjunctions, transitivity, and lexis), the article points to the possibility of systematically integrating LL skills development and content learning through understanding and organizing activities around the KF. By looking at activities from the KF point of view, the content of a subject area

is neither neglected nor replaced by attention to language, as language is situated as an integral part of the content activity and used by students resulting in more meaning-oriented learning.

The analysis further identifies a potential shortcoming in the Standards by revealing benchmark grade levels where specific content indicators lack systematic thinking and LL skills requirements. Analytical and observations and commentary address both the document and the instructional design over which the teachers have more direct control.

The KF analysis of the standards in specific content areas not only provides a vision for how integration can be realized at both curriculum and instructional levels, but provides a framework that can help teachers to translate even limited standards into comprehensive and balanced learning opportunities. Developing students' academic language proficiency is the responsibility of all classroom teachers across the curriculum. In a recent study by O'Toole and O'Toole (2002), it was found that communication difficulties in specialist contexts are not restricted to "minority groups". Every one needs LL support. Thus, if the standards are to be achieved by all students, integration of academic LL proficiency and content learning must take place in all classrooms.

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## Figures:

Figure 1. Linguistic Features Associated with Different KSs (Mohan & Huang, 2002)

| | CLASSIFICATION | PRINCIPLES | EVALUATION |
|---|---|---|---|
| **General Theoretical Level** | * Generic Reference<br>* Relational Process<br>* Additive Conjunction<br>* Taxonomic, Part/Whole Lexis | * Generic Reference<br>* Material Process<br>* Consequential Conjunction<br>* Cause-Effect Lexis | * Generic Reference<br>* Mental Process<br>* Comparative Conjunction<br>* Evaluative Lexis |
| **Specific Practical Level** | * Specific Reference<br>* Relational, Existential Process<br>* Additive Conjunction<br>* Attributive Lexis | * Specific Reference<br>* Material Process<br>* Temporal Conjunction<br>* Sequential Lexis | * Specific Reference<br>* Mental Process<br>* Alternative Conjunction<br>* Oppositional, Choice Lexis |
| | **DESCRIPTION** | **SEQUENCE** | **CHOICE** |

Figure 2: Level of Language/Literacy Demands in the NJCCCS

| Subjects / Items for analysis | WP Readiness | Arts | Health & Phy. Ed. | Math (1996) | Math (2002) | Science (1996) | Science (2002) | Social Studies |
|---|---|---|---|---|---|---|---|---|
| # of standards | 5 | 6 | 6 | 15* | 5 | 12 | 10 | 9 |
| # of indicators | 57 | 28 | 99 | 256* | 434 | 157 | 240 | 120 |
| # (%) of indicators signaling LL requirements | 26 (46%) | 13 (46%) | 82 (83%) | 115 (45%) | 239 (55%) | 114 (73%) | 190 (79%) | 100 (83%) |

* Note: Standard 16 and the accompanying 11 indicators have been excluded from the analysis of the 1996 Math Standards due to the fact that they do not directly address student performance.

Figure 3: Percentage of uses of items associated with different KSs among all items signaling language/literacy demands

| # of Progress Indicators signaling LL demand | # of items signaling **Classification** | # of items signaling **Description** | # of items signaling **Principles** | # of items signaling **Sequence** | # of items signaling **Evaluation** | # of items signaling **Choice** |
|---|---|---|---|---|---|---|
| WPR Total: 26 | 6 (23%) | **9 (35%)** | **9 (35%)** | 6 (23%) | **8 (31%)** | 5 (19%) |
| Arts Total: 13 | 3 (23%) | **4 (31%)** | **5 (38%)** | 2 (15%) | **4 (31%)** | 4 (25%) |
| H.& Ph.Ed. Total: 82 | 30 (37%) | **58 (71%)** | **50 (61%)** | 32 (39%) | **32 (39%)** | 28 (34%) |
| Math (1996) Total: 115 | **35+12 (41%)** | 35 (31%) | **51 (44%)** | 20 17%) | **37 (32%)** | 32 (28%) |
| Math (2002) Total: 239 | 28+27 (23%) | **61+9 (29%)** | **37+11 (20%)** | 25+9 (14%) | **26+5 (13%)** | 22+4 (11%) |
| Science (1996) Total: 114 | **21+4 (22%)** | 18 (16%) | **42 (37%)** | 11 (10%) | **15 (13%)** | 7 (6%) |
| Science (2002) Total: 190 | 25+11 (19%) | **52+4 (29%)** | **54+30 (44%)** | 15+4 (10%) | **13 (7%)** | 9+2 (6%) |
| S. Studies Total: 100 | 30 (30%) | **56 (56%)** | **48 (48%)** | 42 (42%) | **42 (42%)** | 27 (27%) |
| **Total (1996): 450** | 141 (31%) | **180 (40%)** | **205 (46%)** | 113 (25%) | **138 (31%)** | 103 (23%) |
| **Total (2002): 650** | 160 (25%) | **253 (39%)** | **244 (38%)** | 135 (21%) | **130 (20%)** | 101 (16%) |

Note: 1. The bolded parts are the areas where higher LL demand is shown in a given subject area. 2. An item may signal LL skills associated with more than one KS, hence the add-up may exceed the total number of items in a given content area. 3. In the areas of science and math, the numbers following the + signs are for those items articulated in general terms such as "understand" or "know".

**Appendix I:**

Verb phrases identified as those indicating obvious or potential (those in brackets) LL demands in the NJCCCS (1996, 2002).

1. adapt information
2. analyze
3. argue
4. assess
5. cite
6. clarify
7. classify
8. communicate
9. compare and contrast
10. construct arguments
11. define
12. demonstrate a knowledge of how …
13. describe
14. determine
15. develop generalization/plan/ meaning/ theory/procedures
16. differentiate
17. discuss
18. (distinguish processes that… /between things that…)
19. draw conclusions
20. draw inferences
21. estimate
22. evaluate
23. (examine (the lives and contributions of …))
24. explain
25. express information about
26. follow directions
27. form generalization
28. formulate hypothesis/questions/arguments/ problems
29. generate hypothesis
30. give directions
31. give examples/reasons
32. identify interests
33. illustrate
34. interpret
35. (investigate the impact of …)
36. judge
37. justify
38. keep a journal
39. make generalization/inferences/ prediction/conjectures
40. name
41. offer critique
42. (order)
43. organize information/data
44. plan, develop … a proposal
45. plan experiments/solutions
46. pose problems
47. predict
48. prepare resume
49. propose
50. provide criticism/solutions/feedback
51. read and write about
52. recognize its roles
53. record
54. reflect
55. report on
56. (relate … to their function)
57. (represent … in an organized way)
58. (select a problem)
59. (solve problems)
60. (sort)
61. state a problem
62. suggest strategies
63. summarize
64. synthesize information/facts/interpretations
65. use data to assess/ theory to explain/ open sentences to describe
66. use sentences/written methods/reasoning
67. validate thinking
68. verify generalization/correctness
69. weigh evidence
70. write

**Appendix II:**

The following figures provide examples from three content areas to demonstrate how progress indicators for the same content topic may be organized into the KF.

**Example 1: Math (2002)**

Standard 4.1 for Grade 2: Number and Numerical Operations

| CLASSIFICATION | PRINCIPLES | EVALUATION |
|---|---|---|
| • Understand that numbers have a variety of uses. | • Understand the relationship between addition and subtraction. | • Check the reasonableness of results of computations. |
| • Compare whole numbers. | • Order whole numbers. | • Judge without counting whether a set of objects has less than, more than, or the same number of objects as a reference set. |
| **DESCRIPTION** | **SEQUENCE** | **CHOICE** |

**Example 2: Science**

Standard 5.1 for Grade 8: Scientific Processes

| CLASSIFICATION | PRINCIPLES | EVALUATION |
|---|---|---|
| • Collect, organize the data result from experiments. | • Interpret the data that result from experiments. | • Evaluate the strengths and weaknesses of data, claims, and arguments. |
| • Recognize that curiosity, skepticism, open-mindedness, and honesty are attributes of scientists. | • Know how to use appropriate safety equipment with all classroom materials. | • Communicate experimental findings to others. |
| **DESCRIPTION** | **SEQUENCE** | **CHOICE** |

**Example 3: Social Studies**

Standard 6.8 for Grade 8: All students will acquire geographical understanding by studying human systems in geography.

| CLASSIFICATION | PRINCIPLES | EVALUATION |
|---|---|---|
| • Identify the spatial patterns of settlement in different regions of the world (PI 7) | • Give reasons for the changes in spatial patterns of human activities (PI 9) | • Analyze demographic characteristics of populations (PI 6) |
| • Compare demographic characteristics of populations (PI 6) | • Describe how changes in technology affect the location of human activities (PI 10) | • Determine the reasons for variation (PI 6) |
| **DESCRIPTION** | **SEQUENCE** | **CHOICE** |

*Note:* *: *PI: Progress Indicators.*

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